Development of a differential photo-acoustic detector with high Q-factor

D.R. Makashev[1], G.K. Raspopin[1], A.V. Borisov[1], Yu. V. Kistenev[1]
[1]Tomsk State University, Lenin Ave. 36, 634050, Tomsk, Russia.

A promising direction in non-invasive diagnostics of diseases is the study of exhaled air samples. Photo-acoustic spectroscopy is one of the most sensitive gas analysis methods with a detection limit reaching pptv. [1] In resonant photo-acoustic detectors (PAD) acoustic resonance is used to enhance the acoustic signal proportionally to the quality factor Q of a that PAD. [2]

Acoustic resonances of a photo-acoustic detector with differential cylindrical resonators are studied numerically upon variation of their main geometric parameters. Dependences of quality factor of the acoustic resonance and the resonance frequency on geometric parameters of the PAD are obtained and analyzed. Two optimal geometric configurations were tested in practice. Difference between experimental and theoretical results were noted and analyzed.

The obtained results are of interest for development of photo-acoustic gas analyzers.

The research was supported by the Grant of the Russian Ministry of Education and Science (Agreement No. 075-15-2021-1412 (13.2251.21.0128) dated 12/23/2021, unique contract identifier RF 2251.62321X0012).

References

1. Raspopin G. K. et al. Analysis of high-frequency acoustic resonances of an opto-acoustic detector with differential Helmholtz resonators // Optics and Spectroscopy. – 2022. – V. 130. – №. 4. – P. 278-283.

2. Miklós A., Hess P., Bozóki Z. Application of acoustic resonators in photoacoustic trace gas analysis and metrology // Review of scientific instruments. – 2001. – V. 72. – №. 4. – P. 1937-1955.